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The Commonwealth of Massachusetts

Department of Labor and Industries

DIVISION OF OCCUPATIONAL HYGIENE

OCCUPATIONAL HEALTH HAZARDS IN MASSACHUSETTS INDUSTRIES

VI. FUR CLEANING

November, 1938

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FOREWORD

The survey described in the following report is one of a series of industrial health studies conducted by the Division of Occupational Hygiene of the Massachusetts Department of Labor and Industries, in co-operation with the Works Progress Administration, as part of the Industrial Chemical Survey Project, W. P. A. No. 65-14-6060. This survey was supervised by Hervey B. Elkins, chemist, and W. C. L. Hemeon, engineer of the division. The purpose of this work is to secure, as a basis for constructive preventive effort, knowledge of the extent and manner of use of the more important potentially hazardous chemicals in the industries of the Commonwealth. The wholehearted assistance of the establishments visited is gratefully acknowledged.

THE SERVICES OF THE DIVISION OF OCCUPATIONAL HYGIENE ARE AVAILABLE ON REQUEST IN CONNECTION WITH MATTERS PERTAINING TO THE HEALTH OF INDUSTRIAL AND MERCANTILE WORKERS.

OCCUPATIONAL HEALTH HAZARDS IN MASSACHUSETTS INDUSTRIES

VI—FUR CLEANING

In the summer of 1935 the division was informed of an alleged case of carbon tetrachloride poisoning in a worker engaged in the cleaning of furs. Investigation of his working conditions was followed by a brief survey of other similar establishments in order to find out the prevailing methods of controlling the fumes evolved. Such great differences were found in the nature of the ventilating devices, etc., used, that a further study of these processes seemed desirable. This study, the main part of which was carried out in 1936, has been followed by preventive improvements in ventilation under the division's supervision in the two years following.

The cleaning of furs is not an industry in itself but is usually carried out in a separate department of a dry cleaning or a fur retailing establishment. The number of workers involved is not great, but a substantial proportion of those employed are exposed to toxic solvents. Special equipment is required for satisfactorily cleaning furs and dry cleaning plants without such equipment do not often engage in fur cleaning. The business is highly seasonal, being carried out almost entirely in the spring and summer months.

Fifteen establishments, employing a total of forty-six wage earners in fur cleaning processes, were visited in this survey. Measurements of the exposure to solvent vapors were made in eleven plants. The establishments visited may be classified according to the type of activity chiefly carried out, as follows:

Table I.—Fur Cleaning Establishments by Affiliated Business.

Industry	No. Establishments	No. Employees
Retail Furriers	10	36
Dry Cleaners	4	4
Fur Dressers	1	6

Of the firms visited, one retained a full time physician, five had nurses and one required pre-employment medical examinations.

In cleaning fur coats, the lining of the coat is first saturated with a mixture of carbon tetrachloride or trichlorethylene (usually the former) and naphtha, which is applied by means of a sponge or brush. The time required for this operation varies greatly with the condition of the coat, the average garment requiring three to five minutes of sponging. The coat is then placed in a closed drum and, when four to six pieces have been so treated, sawdust is added and the drum is rotated slowly for about an hour. The coats are then removed and placed in a perforated drum, where they are again tumbled for about an hour. Following this, the seams of the linings are opened and the sawdust trapped in the coat is blown out or removed by other means.

The chief exposure to solvent vapors occurs during the sponging of the coats and their removal and handling after drumming. The severity of exposure varies greatly in different plants, depending on the presence or absence of effective ventilating devices and the amount of work done. In many small establishments one worker carries out all the processes. In such a case up to half his time may be spent on operations involving little or no exposure to solvent. On the other hand, one or more workers might work continually at sponging or drumming in the larger establishments.

In Table II the extent to which the plants were equipped with mechanical exhaust for various operations is shown. Only operations 1 and 2 involve appreciable exposure to solvent vapors, the exhaust systems on the other machines being primarily for the removal of sawdust.

Table II.—Fur Cleaning Establishments Using Mechanical Exhaust.

Equipment	Operation	Mechanical Exhaust	No Mechanical Exhaust
Cleaning Table	1. Saturating lining of fur pieces with cleaning solution	9	6
Rotating Drums	2. Rotation of fur pieces in drum	4	11
Sawdust Shaking Drum	3. Removal of surface sawdust from fur pieces	6	0
Beating Table	4. Beating of furs	3	0
Blowing Table	5. Removal of trapped sawdust from linings of fur pieces	10	5

Table III summarizes the results of 88 air analyses made adjacent to various fur cleaning operations. All the analyses except those inside the drums are indicative of the average exposure of one or more workers for periods of half an hour or more. The data on trichlorethylene have been combined with those on carbon tetrachloride in this table.

Table III.—Air Analyses in Fur Cleaning Establishments.

Operation	No. Tests	Concentration Carbon Tetrachloride (parts per million)			Concentration Total Organic Vapors (parts per million)		
		Min.	Max.	Avg.	Min.	Max.	Avg.
1. Saturating lining of fur pieces with cleaning solution	22	<5	195	80	10	195	120
2. Rotation of fur pieces in drums and removal of furs therefrom	23	<5	330	80	45	375	150
3. Removal of trapped sawdust from linings of fur pieces	20	<5	50	15	<10	375	35
4. Room conditions (approximate center of room)	18	<5	25	10	<10	145	35
5. Inside rotating drum	5	130	820	490	855	890	875

It was found that the exposure to carbon tetrachloride during the sponging process (1) varied from less than 5 to nearly 200 parts per million parts of air. The accepted maximum safe concentration for continued exposure is 100 parts per million. As a rule the concentration was below this value only when the work was done at a properly hooded and exhausted table.

In the process of loading drums with furs and their removal therefrom (2), a similar range of exposures was found. If the drums were tight and equipped with a good exhaust, the concentration of carbon tetrachloride vapor was low; otherwise it was usually above the threshold concentration.

The other operation tested (3) did not involve an appreciable exposure to carbon tetrachloride in any case, nor did the general air of the rooms contain any important quantity of vapor. Exposure to the high concentrations found inside the drums (5) occurred momentarily in some cases where the worker put his head inside the drum in removing the coats.

Naphtha vapor concentrations were negligible in all cases.

Four different systems of mechanical ventilation were found on the various sponging tables. The concentrations of carbon tetrachloride (and trichlorethylene) vapor found in the various cases are shown in Table IV.

Table IV.—Vapor Concentration and Ventilation of Sponging Tables.

Type of Local Exhaust	No. of Tests	Conc. Carbon Tetrachloride or Trichlorethylene (p.p.m.) Min.	Max.	Avg.
Hooded table, lateral exhaust	3	5	10	5
Glass top table; operation completely enclosed	1	10	10	10
Wall fan adjacent to table, no hood	2	25	195	110
Exhaust through slots at all edges of table	2	150	180	165
No mechanical ventilation	4	70	140	100

It is readily seen from the results given in the above table that the hooded table and glass topped table provided adequate control of vapors in all cases and that adequate control was realized in one of the plants by means of a wall fan adjacent to the table. Two plants had specially constructed tables with metal sides extending a few inches above the table surface and exhaust inlets running around the edges inside these barriers. In both cases an excessive concentration of carbon tetrachloride vapors was found.

A more fundamental reason for the successful operation of some installations and not of others became apparent with measurement of air velocities at the central points of the working areas of various tables as induced by the exhaust fan. These measurements are summarized in Table V.

Table V.—Air Flow and Vapor Concentration at Sponging Table.

Type of Local Exhaust	Air Velocity at Working Point (feet per minute)	Average Concentration Carbon Tetrachloride (parts per million)
Hooded table; lateral exhaust	(a) 160 (b) 70	30 10
Glass top table; operation completely enclosed	170	10
Wall fan adjacent to table, no hood	(a) 80 (b) 0-50	25 195
Exhaust through slots at all edges of table	0-50	180

These figures indicate quite clearly that a current of air away from the workers' breathing zone, having a velocity of 70 feet per minute or more, is adequate to remove the vapors incident to the sponging process. It does not matter what form of sponging table or arrangement of exhaust is employed to secure this result. However, certain forms of tables accomplish the desired results very much more economically than others, that is to say, with much smaller fan capacity. The hooded table is the easiest and cheapest to construct and consists in its simplest form of a wall attached to the back of the table with sides and top extending a short distance toward the front and with an exhaust inlet in this back wall at about the level of the table top. An installation in which the table is located next to an outside wall in which there is a propeller type fan can obviously be modified to conform to the type above described by the simple expedient of adding partial sides and a top to the back portion of the table.

Air analyses at the two places using trichlorethylene instead of carbon tetrachloride furnish an interesting comparison. Neither of these establishments provided local exhaust ventilation for the sponging table. The results of the analyses in these plants, in comparison with similar ones using carbon tetrachloride, are shown in Table VI.

Table VI.—Relative Concentrations of Carbon Tetrachloride and Trichlorethylene in Sponging Operations.

	Chlorinated Solvent Used	No. Tests	Average Concentration of Vapor (parts per million)	
Plant 1.	Trichlorethylene	1	70	
" 2.	"	2	105	
Avg.				95
Plant 3.	Carbon Tetrachloride	1	120	
" 5.	" "	1	195	
Avg.				160

While the number of these tests is not sufficient to justify any definite conclusion, it would appear that the exposure to trichlorethylene vapor is less than that to carbon tetrachloride vapor under similar conditions. This is probably due mainly to the lower vapor pressure of the former solvent (70 mm. against 115 mm.).

Unfavorable experience with carbon tetrachloride was reported in several establishments, the chief symptoms complained of being nausea and headaches. In addition to the case mentioned on page 3, compensation claims have been filed for two other workers in fur cleaning plants since completion of the main part of the survey. In one case the worker died of a condition induced by liver damage, which was, however, diagnosed as not being due to carbon tetrachloride poisoning. There were no reports of illness of any kind from workers using solely trichlorethylene. This is further indication of the lower toxicity of this solvent in comparison with carbon tetrachloride.

RECOMMENDATIONS

Sponging tables should be partly covered with a hood through which an adequate exhaust is maintained. Drums should be kept tight and drum enclosures should also be exhausted.

The detrimental effects of exposure to chlorinated solvent vapors are augmented by excessive use of alcohol. Persons suffering from kidney or liver ailments should not work with carbon tetrachloride.